OBSERVATIONS ON A CHINESE BRAIN.

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THE following is a description of the external anatomy of a Chinese brain, including notes as to its weight and capacity. It belonged to a Chinaman, aged 36, who was admitted into this asylum last year suffering from general paralysis. Of this the physical signs were the most pronounced. His gait was very weak and unsteady, tongue markedly tremulous, speech very defective, almost abolished, pupils irregular and unequal, knee reflex exaggerated. Mentally he manifested a considerable amount of *bien être*, laughed in a silly, fatuous manner, and at times had many delusions of grandeur. The disease was cut short by the patient dying seven weeks after admission from an attack of pneumonia, and we may fairly take it that there had not been sufficient time for it to produce any marked atrophy of the convolutions which might cause an apparent alteration in their arrangement.

Literature.—The first report on any Chinese brain appears to be that[1] in 1886 by Mills and Parker. Three others[2] were described soon after by Benedict. Dercum in 1889 reported two more,[3] and again in 1892 he published notes on an additional one.[4] As far as possible a comparison will be made between this eighth Chinese brain now under consideration, and the above previously described ones.

[1] "Preliminary Study of a Chinese Brain," by A. J. Parker and C. K. Mills, *Journal of Nervous and Mental Disease*, vol. xiii., No. 10, 1886.
[2] "Drei Chinesen Gehirne," by Prof. Dr. M. Benedikt, *Medicinische Jahrbücher*, 1887.
[3] "A Description of Two Chinese Brains," by F. X. Dercum, *Journal of Nervous and Mental Disease*, July, 1889.
[4] "Note on a Chinese Brain," by F. X. Dercum, *Journal of Nervous and Mental Disease*, September, 1892.

Shape and Size.

Without resorting to the balance, the brain is easily noticed to be considerably smaller than those we are accustomed to see, and to be of a peculiar shape. The difference in shape appears chiefly due to the increase in the greatest transverse diameter as compared with the antero-posterior. On actual measurements of the cranial cavity, the greatest width was found to be 14 cm. (5·5 in.), and the extreme length 15·5 cm. (6·125 in.). The cephalic index is therefore 90, and the skull a markedly brachycephalic one. The hemispheres viewed from above do not display their usual fairly regular oval contour. From the region of the parietal eminences, the point where they attain their greatest width, they rapidly taper towards the extremities, reminding one of the simian cerebrum; this is chiefly noticeable posteriorly, causing the occipital lobes to look small and pointed. From the hinder part of the corpus callosum the hemispheres appear to gradually gape asunder till at the extremities of the occipital lobes they are an inch and a half apart. Looking at the base of the brain, there is none of the eversion of the basal surface of the frontal lobe, noted as being present in all the previously described specimens, but there is well marked eversion of the basi-temporal surface. Benedict noted this in each of his three specimens. In this brain the anterior parts of the temporo-sphenoidal lobes are poorly developed, being thin and wedge-shaped.

The weight of the whole brain is 1,182 grammes (38 oz.), that is, 176 grammes less than the weight of an average male adult brain. This diminution in weight is not shared by each division of the brain, but belongs to the cerebral hemispheres; for these weigh together only 995 grammes, while the average weight of them in a normal European brain is 1,171 grammes. The cerebellum weighs 163·2 grammes, and the pons and medulla together 23·3 grammes, these being just about average weights.

The cubic capacities of the several parts were ascertained by immersing them in graduated glass measures, partially filled with water, and the following figures were obtained :—

Capacity of the hemispheres, 822 cc. (50 c. in.); cerebellum, 141·7 cc.; pons and medulla, 21 cc. Comparing, in man and in apes, the proportion the cerebral hemispheres bear to the cerebellum, in the case of the former it is as $8\frac{1}{2}$ to 1 and $5\frac{3}{4}$ to 1 in the chimpanzee (Huxley). Making a similar calculation in this Chinese brain the proportion is exactly 5 to 1. Supposing that our specimen is fairly typical of a normal brain of that race, and even allowing that there was sufficient time for the disease from which the man was suffering to produce some atrophy, even then there must be a considerable difference in the degree of the relative development of the cerebrum and of the cerebellum to account for the above remarkable change in the proportion.

The Five Fissures.

The Fissure of Sylvius gives off quite normally on each side its small anterior and ascending branches, and continues backwards as usual as the posterior branch. In two of the previous seven brains it is mentioned as being unduly long. In this specimen, as far as the spot where it turns upwards into the tail, it is of normal length; but the tail itself on both sides can be distinctly traced further than usual, especially on the left side. This point will again be referred to under the parietal lobe. On both sides the tail, instead of inclining upwards and backwards, practically forms a right angle with the posterior branch of the fissure, and thus comes really to be directed more forwards than backwards.

The Parieto-Occipital Fissure is well marked on both sides. As regards that part of it on the mesial surface of the hemisphere (the internal parieto-occipital fissure), there is nothing special to notice. Benedict noted that in one of his specimens it did not become on one side confluent with the calcarine fissure. In this brain there is no such abnormality on either side; the calcarine fissure is reached in the usual position, namely, about its middle, on a level with the posterior extremity of the corpus callosum. That portion of the fissure which is situated on the dorsum of the hemisphere

(the external parieto-occipital fissure) is interesting in regard to its length. It makes its appearance at the normal point, midway between the sulcus of Rolando and the occipital extremity of the hemisphere, but is carried to a remarkable extent outwards on both sides, particularly on the right. This part measures generally much less than an inch. In the specimen in hand it extends outwards for an inch and a half on the right side, and an inch on the left. If we take into consideration the general small size of the hemispheres, the length of these fissures would be comparatively greater still. Quain states that the size of the external parieto-occipital fissure depends inversely on the size of the convolution which curves round its outer extremity and connects the parietal with the occipital lobe. And he goes on to say that in consequence of the development in man of this and similar connecting convolutions, this fissure is much less marked in the human brain than in that of the higher apes.

The Calcarine and Hippocampal (or Dentate) Fissures.—In our specimen these two fissures follow a perfectly normal course, except that the former departs somewhat from its usually fairly horizontal direction, its most posterior part being markedly sinuous. On neither side is there the slightest attempt at any confluence between them, the gyrus fornicatus being well developed throughout its whole extent. In each of the three brains described by Dercum, this union took place on both sides; it was present also on both sides in one of Benedict's three cases, and Mills and Parker in their specimen noted that on the right side the gyrus fornicatus became greatly reduced at this spot, the two fissures very nearly becoming continuous.

The Collateral Fissure (Occipito-Temporal) is well marked on both sides, and shows no departure from the normal.

The Frontal Lobe.

The Furrow of Rolando (Central Sulcus) belongs, of course, as much to the parietal as to the frontal lobe, but it is convenient to consider it now. In the previously

described Chinese brains the point, on which stress is laid with regard to it, is the presence or absence of union between it and the Sylvian fissure. In nearly every instance on both sides was this confluence complete or almost complete. It was very nearly so on both sides of the Mills-Parker brain, on the right side of Benedict's first reported specimen, in both hemispheres of his second, on the left side of his third, on the right side of Dercum's first brain, on both sides of his second, and in the left hemisphere of his most recent case. It was freely confluent with the fissure of Sylvius on the right side of Benedict's third specimen, on the left side of Dercum's first, and in the right hemisphere of his latest brain. This apparently regular confluence or approach to it is on neither side observable in the specimen in hand, and certainly on the right side there is a wider loop of grey matter than usual connecting the ascending frontal and parietal convolutions and shutting off the sulcus of Rolando from the Sylvian fissure. The sulcus at its upper end notches the upper margin of both hemispheres, but on neither side is it continued on to their mesial surfaces. Curiously the upper extremity of the right Rolandic furrow is nearly a quarter of an inch behind its fellow ; this is seemingly accounted for by the greater length of the superior frontal convolution on the right side. In both hemispheres the sulcus pursues an uninterrupted course.

The Præcentral Sulcus (*Transverse Frontal Furrow*) is not nearly so much broken up as is usual, and is almost as prominent as the central sulcus, and, as we might therefore expect, there is a particularly well developed ascending frontal (anterior central) convolution. The sulcus on neither side is continued completely to the upper edge of the hemisphere, nor is it on either side confluent with the Sylvian fissure, and therefore, at any rate in this case, cannot be regarded as the prolongation of the ascending branch of that fissure.

The Superior, Middle, and Inferior Convolutions are well developed and distinctly mapped out on either side by the two horizontal sulci. They are subdivided by other secondary

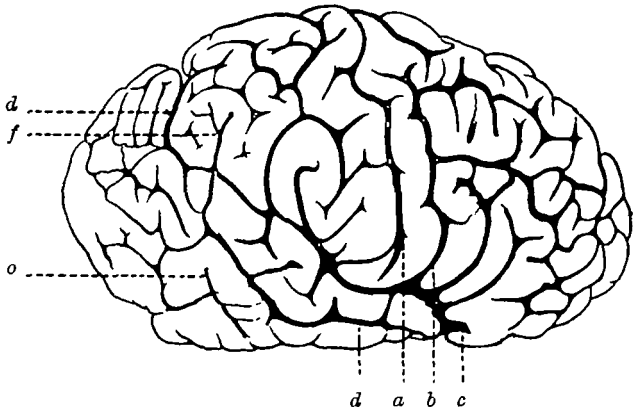

FIG. 1.—Exterior surface of right hemisphere.

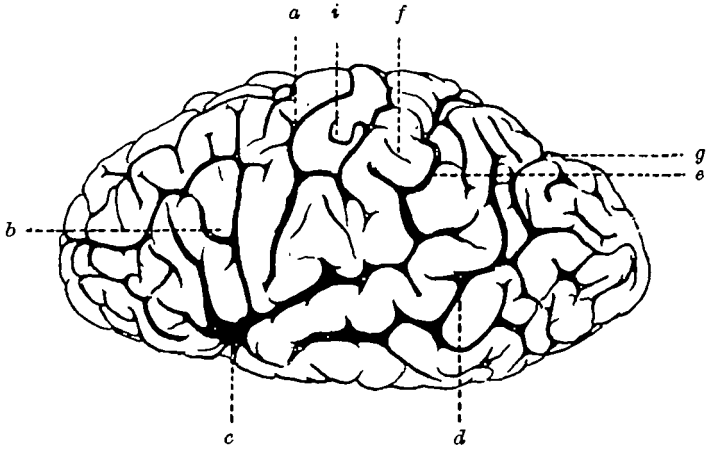

FIG. 2.—Exterior surface of left hemisphere.

ERRATA.

In Fig. 1 the upper *d* should be *f*, and *f* should be *d*, and in Fig. 2 an *f* has been put instead of *j*.

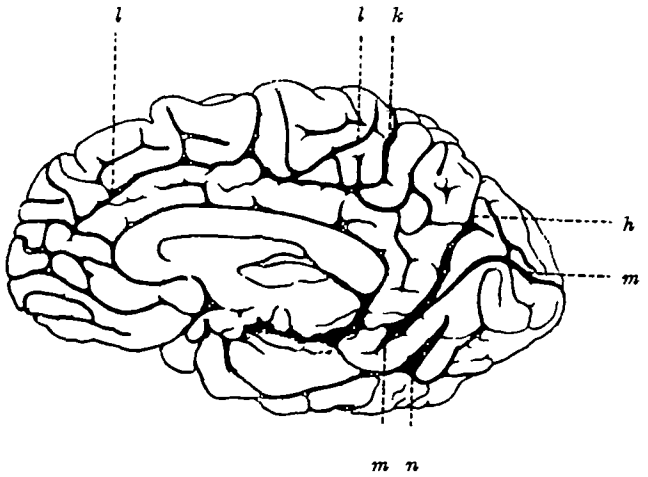

FIG. 3.—Mesial surface of right hemisphere.

a. The sulcus of Rolando.
b. The præcentral sulcus.
c. The Sylvian fissure.
d. The parallel sulcus.
e. Shewing the marked prolongation of the Sylvian fissure on the left side.
f. The external parieto-occipital fissure.
g. Position of the left parieto-occipital fissure.
h. The internal parieto-occipital fissure.
i. The ascending parietal convolution.
j. The provisionally termed posterior ascending parietal convolution.
k. The continuation on to the mesial surface of the post-central sulcus.
l. The calloso-marginal sulcus.
m. The calcarine fissure.
n. The collateral fissure.
o. The middle temporo-sphenoidal convolution.

NOTE.—The upper limit of fig. 2 does not correspond with the upper edge of the hemisphere, but to a line about an inch external to it; hence the marked transverse furrowing is not so well shewn as it might be and the parieto-occipital fissure is not shewn at all.

sulci. The greatest complexity is in the fore part of the frontal lobes; here the gyri are considerably multiplied, and look small and closely packed.

The Orbital Lobule.—The absence of any eversion of this part of the frontal lobe, noted as being present in all the other seven Chinese brains, has been already referred to. The mapping out of its surface into interior, anterior and posterior gyri is not easy; the only one well marked is the internal, and in it on either side is a deep olfactory sulcus.

The Parietal Lobe.

The Intraparietal and Postcentral (Retrocentral) Sulci will be more conveniently studied together. According to the usual description, the former is said to ascend parallel to the sulcus of Rolando for half its extent, and is then directed backwards, blending occasionally with the superior occipital sulcus; and its original direction upward is said to be continued as the postcentral sulcus. On examining the specimen in hand, however, such a description is at once seen to be inapplicable. Here in both hemispheres parallel to the furrow of Rolando is a well marked sulcus, almost as pronounced as the central sulcus itself, in fact more so at its upper end, as it is continued well on to the inner aspect of the hemispheres. On neither side does it open into the fissure of Sylvius. No attempt whatever at any branching from this large transverse furrow is seen on the left side, but in the right hemisphere at the spot where the intraparietal sulcus usually changes its direction, a small branch is given off. Thus in this brain the name postcentral sulcus, besides what is usually meant by that term, would more correctly include the ascending part of the intraparietal furrow. As a result there appears to be in both hemispheres an additional ascending parietal convolution, though on the right side it should be noted that this posterior ascending parietal convolution (if one may so term it) is not so distinct as on the left.

Behind this region the sulci mapping out the remainder of the parietal lobes into other gyri are far from symmetrical

on both sides. In the left one the tail of the fissure of Sylvius is continued upwards to a remarkable extent, practically forming a new transverse furrow taking a course similar to that generally described as belonging to the intraparietal sulcus, for it can easily be followed to within an inch and a half from the upper margin of the hemisphere, and thence is directed backwards at a right angle past the outer extremity of the parieto-occipital fissure and blends with the superior occipital sulcus. In the right hemisphere the configuration of the parietal lobe is more in accordance with the normal. For, as above stated, there is a branch from the large transverse sulcus behind the furrow of Rolando, perhaps representing the hinder part of the intraparietal sulcus; and the tail of the Sylvian fissure can only be said to be continued upwards slightly more than usual. In the previously described Chinese brains there were no variations in the intraparietal sulcus that we are not frequently in the habit of seeing.

The Superior Parietal Lobule.—As follows from the fact that the postcentral sulcus, we saw, was continued on to the inner surface of the hemisphere, on neither side is the upper lobule connected with the true ascending parietal convolution. But in both hemispheres the first annectant gyrus is plainly traceable joining the superior parietal lobule to the upper occipital convolution. On account of the great length of the external parieto-occipital fissure, this annectant gyrus is very sinuous and thin, particularly so on the right side.

The Inferior Parietal Lobule.—Its anterior part termed the supramarginal gyrus appears on the left side to be represented in the lower part of what above has been provisionally called the posterior ascending parietal convolution. That this is so may be gathered from the name given by Turner to this portion of the lobule, namely, the convolution of the parietal eminence, as this part by its protuberance evidently corresponds to the boss of the parietal bone. On the right side, owing to the less complete development of the so called posterior ascending parietal convolution, the supramarginal gyrus is fairly normal. The angular convolution, that is, the hinder part of the inferior parietal lobule, arching over

the upper end of the parallel sulcus, along with the second annectant gyrus, can fairly clearly be traced in both hemispheres.

The Occipital Lobe.

In the three specimens of Dercum, both lobes were observed to be distinctly smaller than normal; especially was this seen in the cuneate lobule. As regards the specimen in hand this fact has been already noted when the general shape and size of the brain were being considered. In the left occipital lobe sulci can be traced dividing it into superior, middle, and inferior convolutions. The third and fourth annectant gyri are seen connecting the last two with the middle and inferior temporo-sphenoidal convolutions respectively. But on the right side three occipital convolutions cannot be made out. The lobe seems divided into two nearly equal parts, the upper, as before said, being joined to the superior parietal lobule by the first annectant gyrus, and the lower has an annectant gyrus connecting it with the inferior temporo-sphenoidal convolution. On neither side is any indication of a transverse occipital sulcus, that is, the small groove said to be generally present in most brains, and directed outwards across the upper part of the occipital lobe a little behind the parieto-occipital fissure. When present it is said to represent the outer portion of the external perpendicular fissure of the ape's brain (*vide* Quain).

The Temporo-Sphenoidal Lobe.

The Parallel or Superior Temporo-Sphenoidal Sulcus is an important one to observe on account of its constancy in all Primates. In the four brains reported by Dercum, Mills, and Parker, attention is drawn to its great length and confluence with numerous perpendicular furrows. In the specimen now studied it is well defined on both sides, and follows very accurately the course of the Sylvian fissure, first backwards, and afterwards being directed perpendicularly upwards, at exactly the same level at which the fissure of Sylvius changes its direction. Its continuation upwards is carried to a remarkable degree on both sides. But there

are none of the transverse confluences mentioned in previous brains observable here, the only junction being that on the left side at the spot where the parallel sulcus changes its direction, the middle occipital furrow opens into it.

Thus a superior temporo-sphenoidal (inframarginal) convolution is well marked on each side. In the right lobe middle and lower temporo-sphenoidal sulci are fairly defined; the former, however, is broken about its centre by a gyrus connecting the middle and lower convolutions together. The middle convolution has no annectant gyrus joining it to the occipital lobe, as is generally the case, but is quite cut off by a small branch from the parallel sulcus first directed backwards, then descending, and ultimately winding into the middle temporo-sphenoidal furrow. Below the inframarginal convolution the left lobe is very irregularly subdivided into small gyri and middle and inferior sulci cannot properly be defined.

The Mesial Surfaces.

The Calloso-Marginal Sulcus.—The usual description given for it applies here in both hemispheres of this specimen, but its termination is not quite symmetrical on the two sides. As is generally the rule, on both sides it ends a short distance behind the upper extremity of the furrow of Rolando, but, while on the right it merely notches the upper margin of the hemisphere, on the left it becomes confluent with the postcentral sulcus. Mills, Parker and Dercum refer to the special complexity of the calloso-marginal sulcus and vegetative repetitions of it were observed by them. None of this is noticed in the present specimen; but in the right hemisphere, as was the case in Dercum's third brain, an apparent addition to the length of the sulcus is seen by its original direction being continued by a furrow in the quadrate lobe also ending by being bent upwards and notching the hemisphere's upper edge.

As regards the convolutions on this surface, no noteworthy peculiarities are observable. The small size of the cuneus has already been referred to, as also has the fact that the gyrus fornicatus is well developed and does not allow of

any attempt at confluence between the calcarine and dentate fissures. The dentate convolution (fascia dentata) was not more pronounced than usual; this fact is noted because in some animals it is much more greatly developed than in man.

Summary.

Before summarizing the above facts it may be well to state here that as regards the markings on the island of Reil and the configuration of the cerebellum, pons and medulla, no departure from the normal is observable.

Although several decided differences from what we look upon as the normal have been pointed out in this and the other seven Chinese brains, the material studied has been too limited to justify general conclusions. But there are certain features which occur with such marked persistency, some of them in all, and others at any rate in the majority of these specimens, that they cannot be regarded as mere coincidences.

First of these stands out the greater prominence given to furrows running transversely as compared to those in the antero-posterior direction. This has been pointed out in every specimen, and is well illustrated in the present case by the three large sulci running parallel with each other in both hemispheres, namely, the central itself with the præ- and postcentral sulci practically as distinct as itself. And in addition to these we have seen on each side an unusually long external parieto-occipital fissure, and that the parallel sulcus was prolonged to a remarkable extent in a transverse direction. This pronounced perpendicular furrowing is still further accentuated on the left side by the undue extension upward of the Sylvian fissure.

Then, as to convolutional complexity, taking the brain as a whole, it is certainly up to the normal standard, and in the frontal lobes even rather beyond the average; this latter point was observed, too, in the first pair of Dercum's cases.

In all his three specimens the occipital lobes, and more especially the cuneate lobules, were noted as not attaining the normal size. This has already been mentioned as being

the case in the present specimen and thus is a point which is constant in at least half the number of brains studied.

If this brain is at all typical of the race to which it belongs, then the small size and weight of the cerebrum as compared to the cerebellum is a point worthy of special emphasis.

It is hoped that the above observations may prove of interest to those who study the comparative anatomy of the human brain, and that as more material accumulates, generalizations of a greater value may be obtained.